

Chemistry Standards and Benchmarks

Standard 1: Understands and applies principles of scientific inquiry

*Power Benchmarks: Identifies questions and concepts that guide science investigations
Uses technology and mathematics to improve investigations and communications
Formulates and revises scientific explanations and models using logic and evidence
Recognizes and analyzes alternative explanations and models*

Course Level Benchmarks	Vocabulary	Knowledge	Skills	Classroom Resources
A. Formulates and revises scientific explanations and models	<ul style="list-style-type: none"> • scientific explanation • scientific model • data • within tolerance • scientific method 	<ul style="list-style-type: none"> • Knows scientific explanations and models are based on data • Knows new data may lead to the modification of scientific explanations and models 	<ul style="list-style-type: none"> • Analyzes data with respect to scientific explanations and models (ACT, SAT, ITED, AP CHEM) • Adjusts scientific explanations and models based on data (ACT, SAT, ITED, AP CHEM) 	Chemistry Curriculum Guide Emphasized throughout the entire curriculum
B. Understands how scientific knowledge changes with new evidence	<ul style="list-style-type: none"> • scientific knowledge • evidence • influence • ethics 	<ul style="list-style-type: none"> • Knows examples of scientific knowledge that changed when new evidence was presented • Knows that science is an ongoing process and is always open to new ideas 	<ul style="list-style-type: none"> • Describes how science concepts have evolved with the discovery of new evidence • Hypothesizes how current science concepts and practices will influence future societies 	
C. Formulates and revises scientific explanations and models	<ul style="list-style-type: none"> • scientific explanation • scientific model • data • within tolerance • scientific method 	<ul style="list-style-type: none"> • Knows scientific explanations and models are based on data • Knows new data may lead to the modification of scientific explanations and models 	<ul style="list-style-type: none"> • Analyzes data with respect to scientific explanations and models (ACT, SAT, ITED, AP CHEM) • Adjusts scientific explanations and models based on data (ACT, SAT, ITED, AP CHEM) 	

Chemistry Standards and Benchmarks

Standard 1: Understands and applies principles of scientific inquiry (con't)

*Power Benchmarks: Identifies questions and concepts that guide science investigations
Uses technology and mathematics to improve investigations and communications
Formulates and revises scientific explanations and models using logic and evidence
Recognizes and analyzes alternative explanations and models*

Course Level Benchmarks	Vocabulary	Knowledge	Skills	Classroom Resources
D. Demonstrates safe handling procedures	<ul style="list-style-type: none"> • OSHA • EPA • MSDS • Right to Know • hazardous • safety procedures 	<ul style="list-style-type: none"> • Knows appropriate safety procedures for a given situation • Knows where safety devices are located in the classroom • Understands the process of waste disposal 	<ul style="list-style-type: none"> • Follows required safety procedures • Recognizes, reports, and corrects safety problems • Follows waste disposal procedures 	<p>Chemistry Curriculum Guide</p> <p>Emphasized throughout the entire curriculum</p>

Chemistry Standards and Benchmarks

Standard 2: Understands and applies principles of physical science

Power Benchmark: Understands and applies knowledge of the structure and properties of matter

Course Level Benchmarks	Vocabulary	Knowledge	Skills	Classroom Resources
A. Shows how periodicity of the elements relates to atomic structure	<ul style="list-style-type: none"> • atom • atomic theory • electron • proton • neutron • nucleus • atomic number • isotope • isotopic symbols • hyphen name • mass number • atomic mass • periodic table • periodicity • main group elements • transition elements • group • period • ground state • excited state • line-emission spectrum • absorption • emission • orbital notation 	<ul style="list-style-type: none"> • Knows the structure of the atom • Understands matter behaves in predictable and understandable ways • Understands the arrangement of the elements of the elements on the periodic table • Understands the structure of matter • Knows how the energy associated with individual atoms and molecules can be used to identify the substances they comprise 	<ul style="list-style-type: none"> • Relates the position of elements in the periodic table to their atomic number and atomic mass (AP CHEM) • Recognizes metals, semimetals, and nonmetals by their position on the periodic table • Describes and interprets trends in properties of elements (AP CHEM) • Determines the number of electrons atoms have available for bonding • Relates the position of an element in the periodic table to its electron configuration • Evaluates the Bohr model of the atom, its significance and its contribution to the current model • Relates spectral lines to the transitions of electrons between energy levels 	Chemistry Curriculum Guide

Chemistry Standards and Benchmarks

Standard 2: Understands and applies principles of physical science (con't)

*Power Benchmark: Understands and applies knowledge of the structure and properties of matter
Understands and applies knowledge of chemical reactions*

Course Level Benchmarks	Vocabulary	Knowledge	Skills	Classroom Resources
B. Recognizes patterns in the properties of matter 1. Forming Bonds	Forming Bonds <ul style="list-style-type: none"> • covalent bonding • ionic bonding • nonpolar-covalent bond • polar • polar-covalent bond • molecule • molecular compound • chemical formula • diatomic molecules • ionic compound • formula unit • metallic bonding • malleability • ductility • octet rule • electron-dot notation • shared pair • unshared pair • lone pair • Lewis structures • structural formula • single bond • double bond • triple bond • multiple bonds • ion 	Forming Bonds <ul style="list-style-type: none"> • Knows atoms are made up of a positive nucleus surrounded by negative electrons • Knows an atom's electron configuration determines how the atom can interact with other atoms • Knows atoms form bonds to other atoms by transferring or sharing electrons 	Forming Bonds <ul style="list-style-type: none"> • Categorizes bonds by type • Generates Lewis dot structures for various chemicals • Predicts the geometry of simple molecules (AP CHEM) • Explains why most atoms form chemical bonds (AP CHEM) • Illustrates ionic, covalent, and metallic bonding • Relates electronegativity and ionization energy to bond formation and bond polarity (AP CHEM) • Correlates the type of bond with the physical properties of the substance (AP CHEM) 	Chemistry Curriculum Guide

Chemistry Standards and Benchmarks

Standard 2: Understands and applies principles of physical science (con't)				
<i>Power Benchmark: Understands and applies knowledge of the structure and properties of matter</i>				
<i>Understands and applies knowledge of chemical reactions</i>				
Course Level Benchmarks	Vocabulary	Knowledge	Skills	Classroom Resources
B. Recognizes patterns in the properties of matter (con't) 2. Chemical Naming	Chemical Naming <ul style="list-style-type: none"> • subscript • nomenclature • numerical prefixes • coefficient 	Chemical Naming <ul style="list-style-type: none"> • Knows symbolic statements can be combined to look for values of variables 	Chemical Naming <ul style="list-style-type: none"> • Determines the formula or name of an ionic compound when given either • Determines the formula or name of a molecular compound when given either 	Chemistry Curriculum Guide

Chemistry Standards and Benchmarks

Standard 2: Understands and applies principles of physical science (con't)

Power Benchmark: Understands and applies knowledge of chemical reactions

Understands and applies knowledge of conservation of energy and increase in disorder

Course Level Benchmarks	Vocabulary	Knowledge	Skills	Classroom Resources
<p>C. Verifies evidence that the conservation of atoms in chemical reactions leads to the principle of conservation of matter</p> <p>1. Chemical Equations and Reaction Types</p>	<p>Chemical Equations and Reaction Types</p> <ul style="list-style-type: none"> • chemical equation • precipitate • reversible reaction • word equation • combustion reaction • composition reaction • decomposition reaction • displacement reaction • double-replacement reaction • electrolysis • single-replacement reaction • synthesis reaction • activity series 	<p>Chemical Equations and Reaction Types</p> <ul style="list-style-type: none"> • Knows electromagnetic forces exist within and between the atoms • Knows materials contain equal proportion of positive and negative charges • Understands chemical reactions either release or consume energy 	<p>Chemical Equations and Reaction Types</p> <ul style="list-style-type: none"> • Recognizes and classifies reactions of various types • Describes chemical reactions with balanced chemical equations (AP CHEM) • Recognizes signs a reaction has taken place (light, heat change, color change, precipitant, gas released, etc.) • Uses the activity series to predict reaction or not (AP CHEM) 	<p>Chemistry Curriculum Guide</p>

Chemistry Standards and Benchmarks

Standard 2: Understands and applies principles of physical science (con't)

Power Benchmark: Understands and applies knowledge of conservation of energy and increase in disorder

Course Level Benchmarks	Vocabulary	Knowledge	Skills	Classroom Resources
D. Uses the gas laws to explain the properties of gases	<ul style="list-style-type: none"> • Kinetic Molecular Theory • ideal gas • elastic collision • kinetic energy • gas laws • pressure • volume • temperature • Standard Temperature and Pressure • constant • absolute zero • direct relationship • inverse relationship 	<ul style="list-style-type: none"> • Understands matter behaves in predictable and understandable ways • Knows the total energy of the universe remains constant 	<ul style="list-style-type: none"> • Summarizes the values and meanings of STP • Relates the temperature of a gas to the average kinetic energy of its particles • Applies the gas laws relationship between pressure, temperature, and volume of any amount of ideal gas (AP CHEM) • Solves problems using the ideal gas law, $PV=nRT$ 	Chemistry Curriculum Guide

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Standard 2: Understands and applies principles of physical science (con't)

Power Benchmark: Understands and applies knowledge of the structure and properties of matter

Course Level Benchmarks	Vocabulary	Knowledge	Skills	Classroom Resources
E. Analyzes solutions and their behavior 1. Properties of Water 2. Solutions	Properties of Water <ul style="list-style-type: none"> • water molecule • water properties • hydrogen bonding • surface tension • vaporization • evaporation • freezing • ice • water quality Solutions <ul style="list-style-type: none"> • soluble • solubility • solvent • solute • electrolyte • nonelectrolyte • surface area • agitating • saturated • hydration • polar/nonpolar • Henry's Law • miscible • concentration • molarity 	Properties of Water <ul style="list-style-type: none"> • Knows water is good at dissolving ionic compounds • Knows how the chemical and physical properties make water an unique solvent Solutions <ul style="list-style-type: none"> • Knows parts of a solution • Understands the factors that affect the dissolving process • Understands compounds are more or less soluble in a solvent • Understands ionization 	Properties of Water <ul style="list-style-type: none"> • Examines the properties of water • Explains how chemistry impacts water quality Solutions <ul style="list-style-type: none"> • Relates the terms solute and solvent to solutions • Determines the concentration of a solute • Interprets a solubility graph (AP CHEM) • Examines the relationship of a solute concentration to solution properties 	Chemistry Curriculum Guide

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Power Benchmark: Understands and applies knowledge of the structure and properties of matter

Course Level Benchmarks	Vocabulary	Knowledge	Skills	Classroom Resources
E. Analyzes solutions and their behavior (con't) 3. Acids, Bases, and pH	Acids, Bases, and pH <ul style="list-style-type: none"> • acids • bases • neutralization • ionization • binary acids • oxyacids • strong/weak acids • alkaline • Arrhenius acids and bases • salt • acid rain 	Acids, Bases, and pH <ul style="list-style-type: none"> • Knows the pH scale is a feature of the concentration of H⁺ and OH⁻ ions in solution 	Acids, Bases, and pH <ul style="list-style-type: none"> • Relates the strength of acids and bases to their tendencies toward dissociation (AP CHEM) • Calculates pH from the hydrogen-ion concentration and interprets its meaning 	Chemistry Curriculum Guide